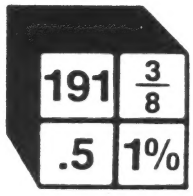
conquering ratios and proportions

instructional computing courseware
for the **apple® II** computer



a product from the series
conquering math

This manual is compatible

with

the ***Conquering Ratios and Proportions*** disk

Version 1.x

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Conquering ratios and proportions [computer file]. —
Version 1.0.

1 computer disk : sd., col. ; 5 1/4 in. + 1 manual. —
(Conquering math series)
System requirements: Apple II series computers; 128K; ProDOS; BASIC; 1 disk drive; monochrome or color monitor; Apple-compatible printer (optional).
Title from title screen.
Edition statement from disk label.
Copy-protected.
Audience: Grades 5-8.
Issued also on 3 1/2 in. computer disk.
Summary: Introduces students to ratios and proportions. Helps them identify and create ratios, find decimal and percentage equivalents to ratios, and form ratios from data tables. Provides practice in setting up proportions and solving proportion word problems. Includes two games to help students practice what they have learned.
Contents: Ratios — Proportions — Create-a-flag — [etc.]
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INTRODUCTION

Conquering Ratios and Proportions gives students an opportunity to work with ratios and proportions in a variety of ways. The program **Ratios** emphasizes many of the introductory concepts associated with understanding ratios. Included are creating and identifying ratios, finding decimal and percent equivalents, and forming ratios by selecting appropriate information from tables of data. The **Proportions** program provides students with practice in setting up proportions and solving proportion word problems. Teacher Options are provided to allow you to regulate the problem types available to students, to control the use of unit rate, and to view and print records of student performance.

The inclusion of integral unit rate (a whole number to 1) in this product offers teachers and students an alternative way of looking at ratios and proportions. Current literature on the use of unit rate, written by subject matter experts and teachers alike, indicates that using unit rate can help students explore the concept of ratios and determine an unknown in proportions. Further reference materials on the use of unit rate are listed in Appendix C on page 30. A detailed description of ratio and proportion problems using unit rate can be found on page 3 of this manual under "Option 1: Problem Settings."

Two games that directly reinforce the instructional objectives introduced in the programs are also included on this disk. The use of these games can be controlled by the teacher through the Teacher Options. **Create-a-Flag** is an activity in which students experiment with various ratios as they design their own unique castle flag. The ability to print these flags can be controlled through Teacher Options. **Catapult Capers** is a problem-solving game in which students use proportional thinking skills to set the correct catapult force to hurl rocks of given weights to hit a target.

Students can exit a program or game by pressing the Escape (Esc) Key twice any time the program is waiting for a response. The sound can also be turned on or off by holding down the Control Key and typing the letter S (Control-S).

To use ***Conquering Ratios and Proportions***, you will need the program disk, a 128K Apple II series computer, a monochrome or color monitor, and a disk drive. If you want your students to print their flags after using the program **Create-a-Flag**, you will also need a printer.

Conquering Ratios and Proportions is part of the ***Conquering Math Series***. This series contains other packages that deal with more advanced whole-number operations, fractions, and decimal numbers. A chart on the next page summarizes the individual packages in the series.

Also available from MECC is the ***Mastering Math Series*** for students in grades 1-4. This series of ten disks deals with the whole-number operations of addition, subtraction, multiplication, and division.

INTRODUCTION (continued)

The ***Conquering Math Series*** is designed for use with students in grades 3-8. Each disk contains Teacher Options that allow the content to be easily adjusted for your particular situation and grade level. Features of the series include intelligent tutoring, visual examples, student record-keeping, and content-related games.

Topic	Product	Number	Grade Level					
			3	4	5	6	7	8
Whole Numbers	***Conquering Whole Numbers*** Whole-number operations (+,-,x,+) with large numbers and regrouping; games included are **Bagels, Tax Collector,** and **Bowling.**	A-201	■	■	■	■		
Fractions	***Fraction Concepts, Inc.*** Definition of fractions, fraction types, roles of numerator and denominator, and equality.	A-202	■	■	■			
	Fraction Practice Unlimited Equivalence, comparing fractions, reducing, and sorting fractions.	A-203		■	■	■		
	Conquering Fractions (+,-) Addition and subtraction of fractional numbers; games included are **Fraction Dash** and **Fraction Chompers.**	A-204		■	■	■	■	■
	Conquering Fractions (x,+) Multiplication and division of fractional numbers; games included are **Fraction Chompers** and **What's My Fraction?**	A-205			■	■	■	■
Decimals	***Decimal Concepts*** Place value, ordering and comparing decimal numbers, rounding, and equivalent fractions.	A-206	■	■	■	■		
	Conquering Decimals (+,-) Addition and subtraction of decimal numbers; games included are **Misplaced Decimals** and **Decimal Dash.**	A-207		■	■	■	■	■
	Conquering Decimals (x,+) Multiplication and division of decimal numbers; games included are **Decimal Chompers** and **Concentration.**	A-208			■	■	■	■
Ratios	***Conquering Ratios and Proportions*** Create and identify ratios, solve word problems using proportions; games included are **Create-a-Flag** and **Catapult Capers.**	A-209			■	■	■	■
Percents	***Conquering Percents*** Visually create and identify percents, solve word problems involving percents; includes the game **Percent Chompers.**	A-210			■	■	■	■
Other	***Conquering Math Worksheet Generator*** Create worksheets using any of the objectives from the ten packages in the ***Conquering Math Series.***	A-260	■	■	■	■	■	■
	Conquering Math Textbook Connection Correlates 1987 edition of five math publishers with the ***Conquering Math Series.***	A-261	■	■	■	■	■	■

TEACHER OPTIONS

Accessing Teacher Options

This package contains several Teacher Options that allow you to adjust problem settings, set the use of unit rate, control the availability of games, and view student results. You can access the Teacher Options menu while viewing the main menu (Figure 1) by pressing Control-A (hold down the Control Key and press the A Key). The Teacher Options menu will appear (Figure 2).

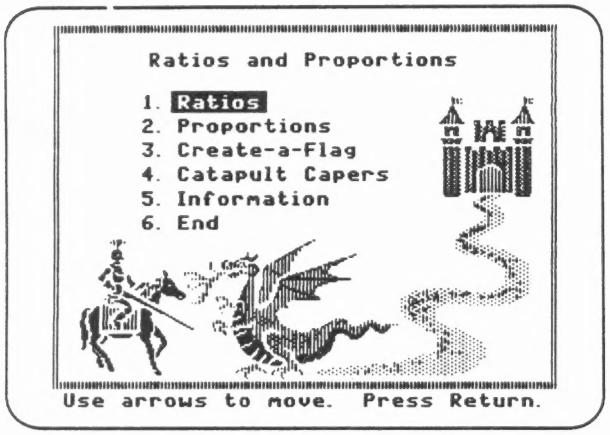

Figure 1

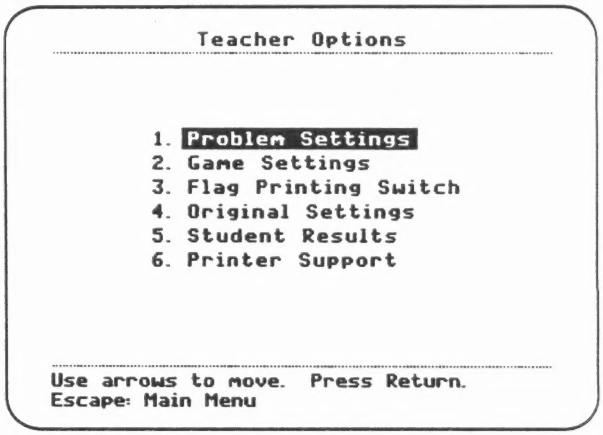

Figure 2

Option 1: Problem Settings

Selecting this option will display a table showing the current problem settings on your disk (Figure 3). The check marks indicate the combination of types being used (Figure 4). The number of problems of each selected type are evenly distributed among the total number of problems being worked. There are three problem types available for **Ratios** and two for **Proportions**. A detailed description of the problem types can be found on pages 8, 9, and 14. The number of problems per session may be set from 5 to 25; the current setting is shown. The mastery level, which can be set from 0 to 100% is also displayed. The use of unit rate can be turned on or off. In **Ratios**, if unit rate is turned on, students are asked to identify unit rates. In **Proportions**, unit rate affects the method of problem solving that is used. With unit rate on, students use unit rate to solve proportions; without it, students use cross-multiplication.

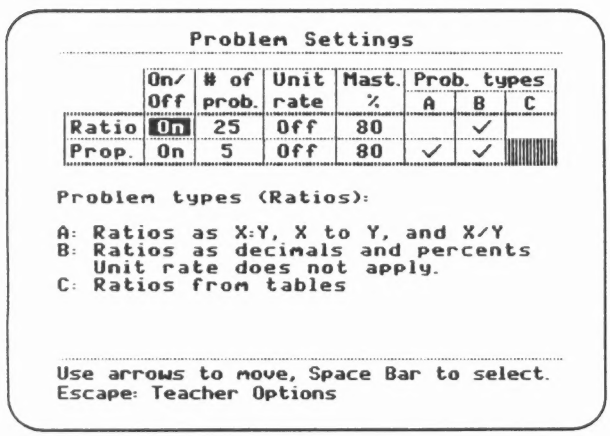
Problem Settings
On/ Off | # of prob. | Unit rate | Mast. % | Prob. types A | B | C
Ratio | On | 25 | Off | 80 | | ✓ |
Prop. | On | 5 | Off | 80 | ✓ | ✓ |
Problem types (Ratios):
A: Ratios as X:Y, X to Y, and X/Y
B: Ratios as decimals and percents
Unit rate does not apply.
C: Ratios from tables
Use arrows to move, Space Bar to select.
Escape: Teacher Options

Figure 3

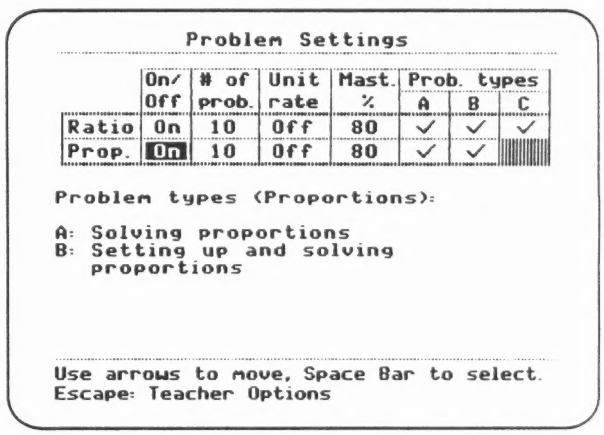
Problem Settings
On/ Off | # of prob. | Unit rate | Mast. % | Prob. types A | B | C
Ratio | On | 10 | Off | 80 | ✓ | ✓ | ✓
Prop. | On | 10 | Off | 80 | ✓ | ✓ |
Problem types (Proportions):
A: Solving proportions
B: Setting up and solving proportions
Use arrows to move, Space Bar to select.
Escape: Teacher Options

Figure 4

TEACHER OPTIONS (continued)

Option 2: Game Settings

Two games involving the use of ratios and proportions are also included on this disk. The Game Settings option allows you to control the availability of these games, and thus determine whether they are used for instructional or motivational purposes (Figure 5). You can set access to the games so that students may use them after completing a problem set, or you may wish to allow students access to the games only when mastery has been achieved. At other times you may want to allow access from the main menu or decide to turn the game access off completely.

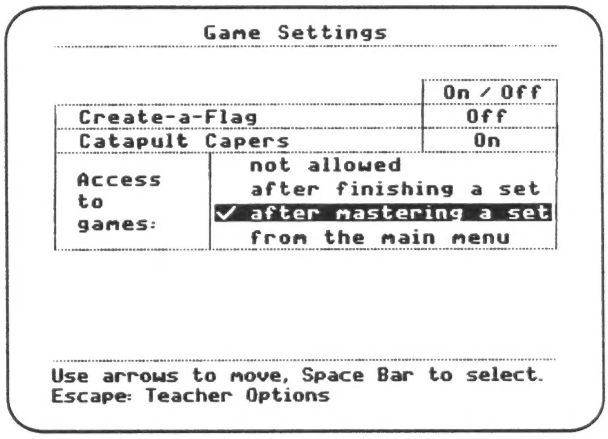

Figure 5

Option 3: Flag Printing Switch

This option allows you to determine if students will be able to print the flags they have created in the **Create-a-Flag** activity (Figure 6). If this option is on, students will be allowed to print the flags they have created. If this option is off, students will not be given the option to print flags.

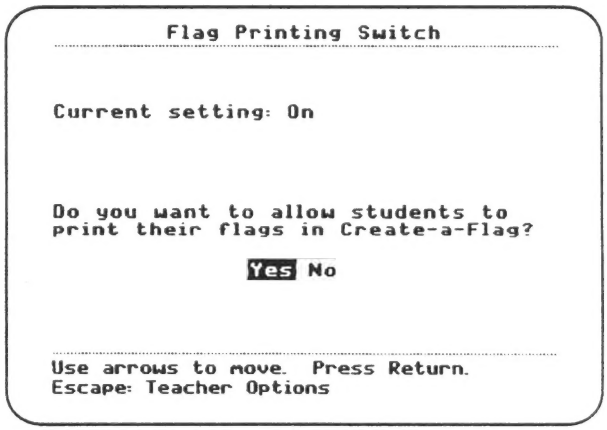
Flag Printing Switch
Current setting: On
Do you want to allow students to print their flags in Create-a-Flag?
Yes No
Use arrows to move. Press Return.
Escape: Teacher Options

Figure 6

Option 4: Original Settings

This option allows you to restore the problem and game settings to their original states. These original settings are shown below in Figure 7 (problem settings) and Figure 8 (game settings).

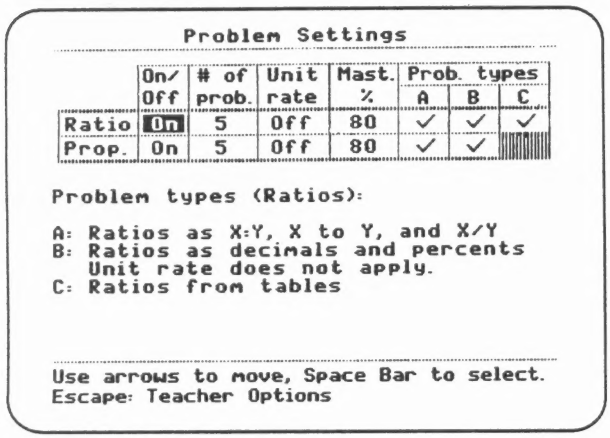

Figure 7

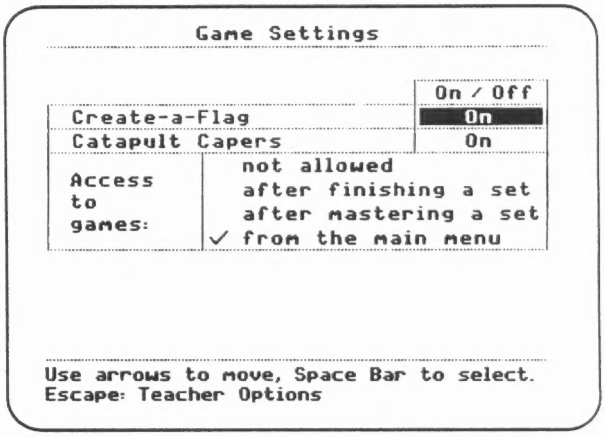

Figure 8

Option 5: Student Results

The disk can store the results for as many as 75 student sessions. Once the results file is filled, the program will automatically start erasing the oldest results as new results are saved (Figure 9). The results displayed indicate the program—**Ratios** or **Proportions** (R or P)—the score (number right on first try/number of problems worked), and whether mastery was reached (Y or N) (Figure 10). If you have a printer attached, you can print any single screen of results as it appears on the screen or you can choose to print all of the results. You may also choose to delete all of the results currently saved on the disk. This "clean-up" feature is especially useful at the start of the year or after a class completes a unit using these programs.

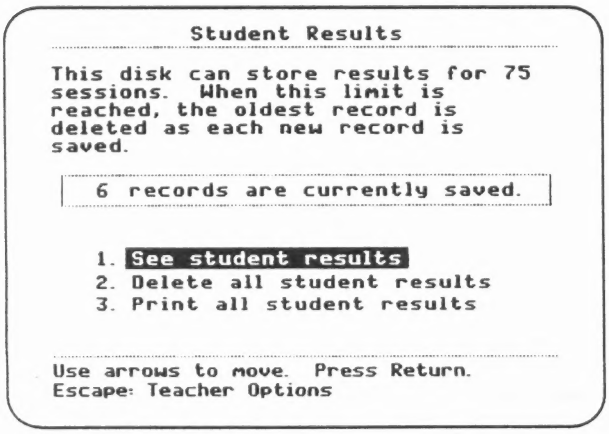
Student Results
This disk can store results for 75 sessions. When this limit is reached, the oldest record is deleted as each new record is saved.
6 records are currently saved.
1. See student results
2. Delete all student results
3. Print all student results
Use arrows to move. Press Return.
Escape: Teacher Options

Figure 9

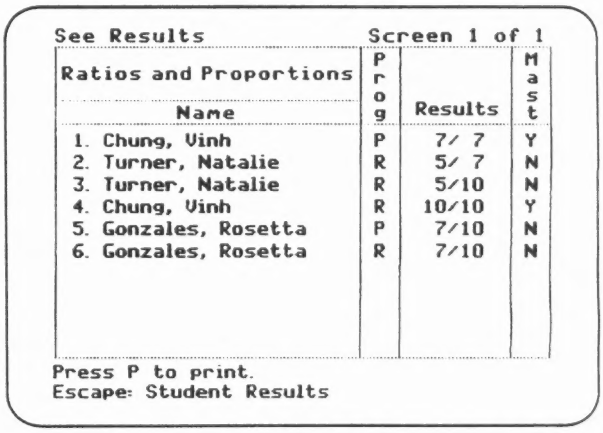

Figure 10

TEACHER OPTIONS (continued)

Option 6: Printer Support

This option is provided in order to accommodate the use of a printer for printing student results and for printing flags that students have designed in the **Create-a-Flag** activity. For detailed instructions on using this option, refer to Appendix B, "Using a Printer with this Courseware," pages 28-29.

DESCRIPTION

Ratios gives students practice with up to three different types of problems involving ratios. The number of problems per session, the problem types presented, and the mastery level are adjustable through the use of the Teacher Options. Appropriate feedback is given when students select an incorrect response. Content-related games can be made available to students following the session.

Curriculum Area:	Mathematics
Subject:	Ratios
Type:	Guided Practice
Grade Range:	5-8
Classroom Use:	Individual

LEARNING OBJECTIVES

After using this program, the student will have received practice in:

- creating visual representations of ratios;
- identifying numeric representations of visually presented ratios;
- equating decimals and percents with a given ratio;
- selecting ratios equivalent to a given percent;
- recognizing appropriate ratios by extracting data from tables of information; and
- finding unit rates.

USE IN AN INSTRUCTIONAL SETTING

Preparation

Since this is a reinforcement activity rather than a tutorial, it is assumed that students have been introduced to the concepts of ratio and unit rate. Before allowing students to use this program, you should review the unit rate option and the three types of problems that are available. If students are not familiar with unit rate, make sure that the option is turned off by using the Problem Settings section of the Teacher Options. Similarly, if students are not ready for any of the problem types listed below, those types should also be turned off in the Teacher Options.

Type A: These problems are presented in two ways. A ratio is given in a sentence and students must visually create it (Figure 1) or a visual ratio is given and students must select the appropriate numeric representation (Figure 2).

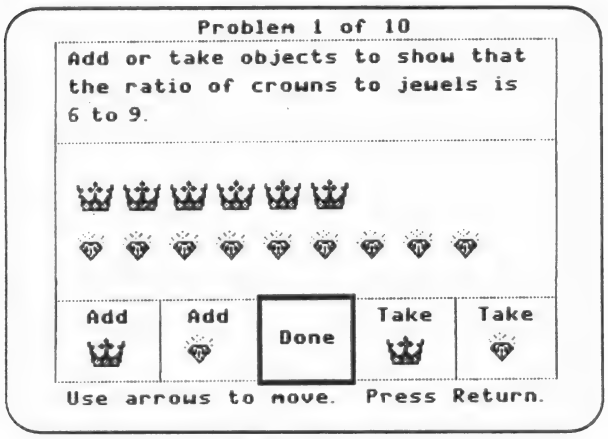
Problem 1 of 10
Add or take objects to show that the ratio of crowns to jewels is 6 to 9.
Add
Add
Done
Take
Take
Use arrows to move. Press Return.

Figure 1

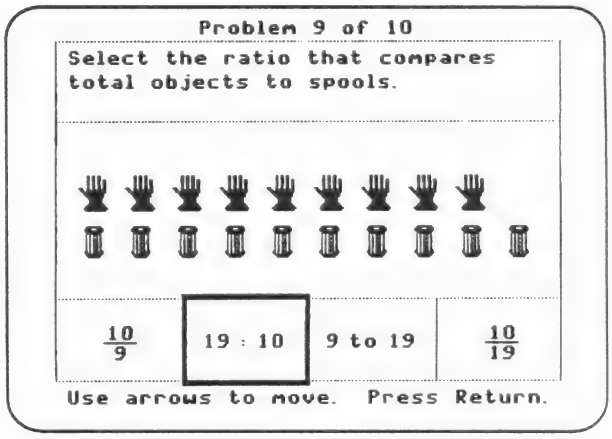

Figure 2

If unit rate is on, students visually create a ratio (Figure 3) and then select unit rate (Figure 4). These are separate problems; thus 12 problems involve 6 ratios and 6 unit rates.

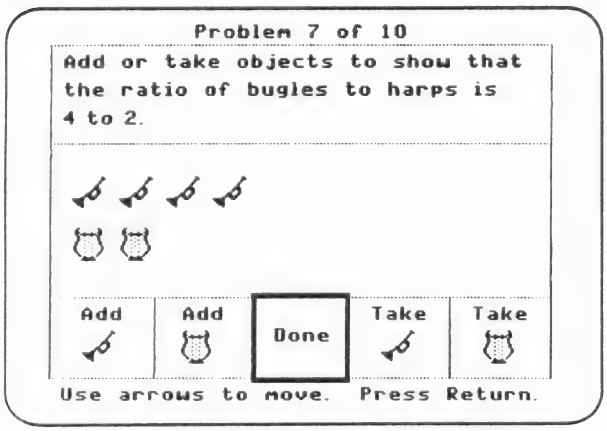
Problem 7 of 10
Add or take objects to show that the ratio of bugles to harps is 4 to 2.
Add
Add
Done
Take
Take
Use arrows to move. Press Return.

Figure 3

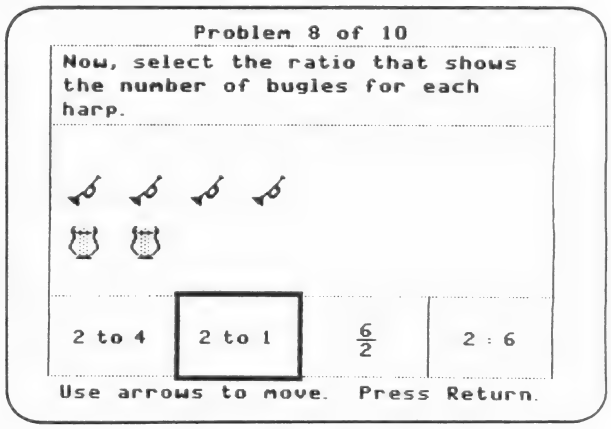
Problem 8 of 10
Now, select the ratio that shows the number of bugles for each harp.
2 to 4
2 to 1
6/2
2 : 6
Use arrows to move. Press Return.

Figure 4

USE IN AN INSTRUCTIONAL SETTING (continued)

Type B: These problems are presented in two ways. A ratio is given and students must select the appropriate decimal or percent equivalent (Figure 5), or a percent is given and students must select the equivalent ratio (Figure 6). Unit rate does not apply to this problem type.

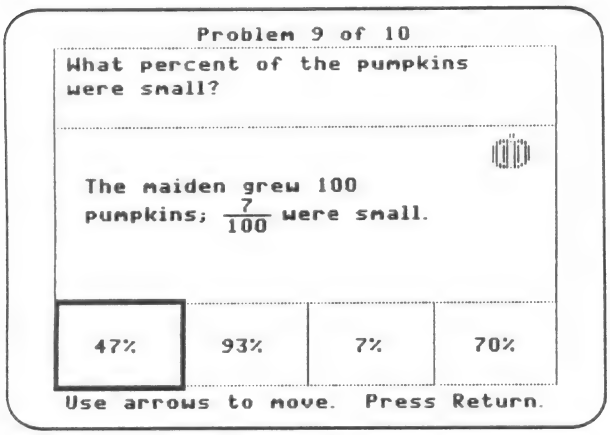

Figure 5

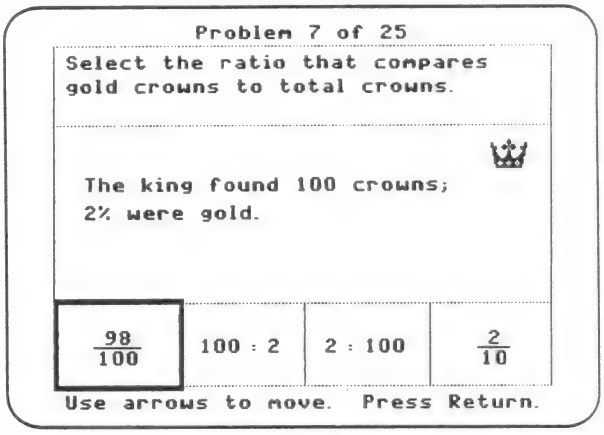
Problem 7 of 25
Select the ratio that compares gold crowns to total crowns.
The king found 100 crowns; 2% were gold.
98/100
100 : 2
2 : 100
2/10
Use arrows to move. Press Return.

Figure 6

Type C: These problems present tables of information from which students must extract data to create a specific ratio (Figure 7). If unit rate is on, students will be asked to identify the unit rate after having first created the correct ratio (Figure 8). As with Type A problems, these are considered two separate problems.

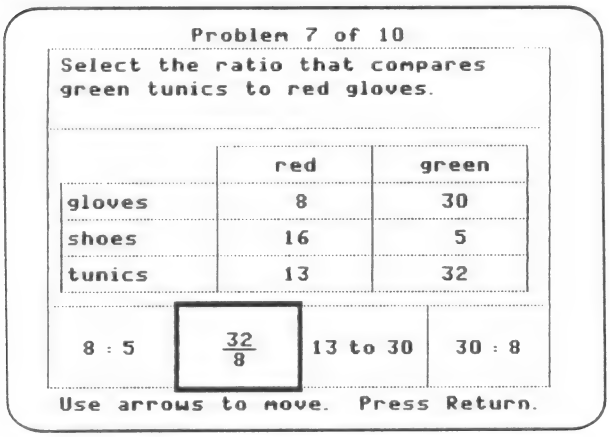

Figure 7

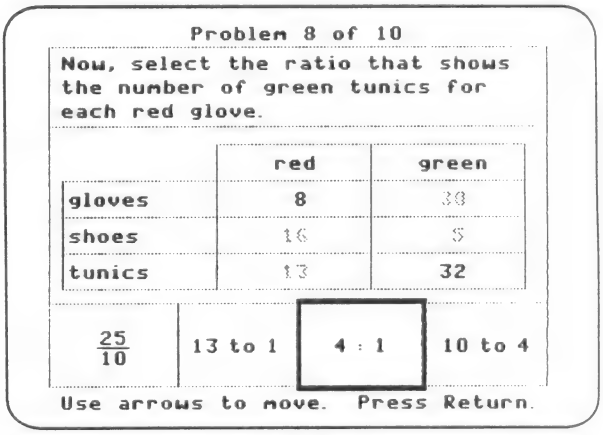

Figure 8

USE IN AN INSTRUCTIONAL SETTING (continued)

Using the Program

This program is meant to be used with individual students. Students must enter their names for record-keeping purposes (Figure 9). They are then given the full set of problems as designed by the teacher through the use of Teacher Options. The basic format of the lesson screen is shown below (Figure 10).

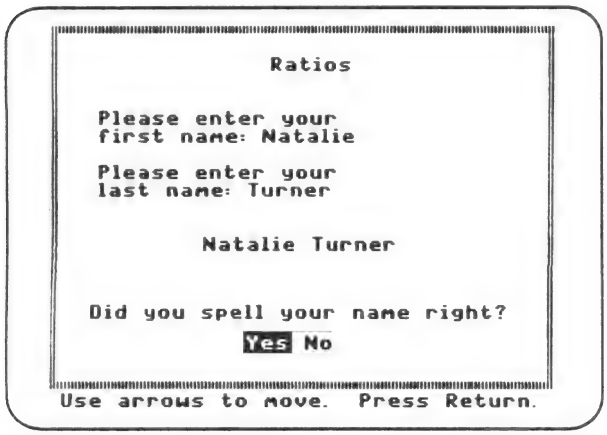
Ratios
Please enter your first name: Natalie
Please enter your last name: Turner
Natalie Turner
Did you spell your name right?
Yes No
Use arrows to move. Press Return.

Figure 9

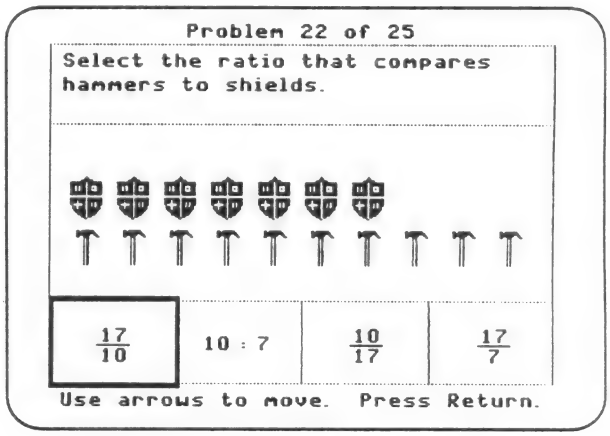

Figure 10

Feedback is given when students select an incorrect response. Students receive appropriate feedback until the correct answer is selected (Figures 11 and 12).

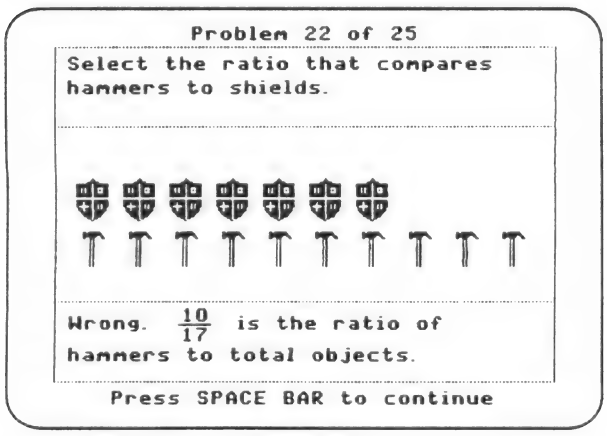
Problem 22 of 25
Select the ratio that compares hammers to shields.
Wrong. 10/17 is the ratio of hammers to total objects.
Press SPACE BAR to continue

Figure 11

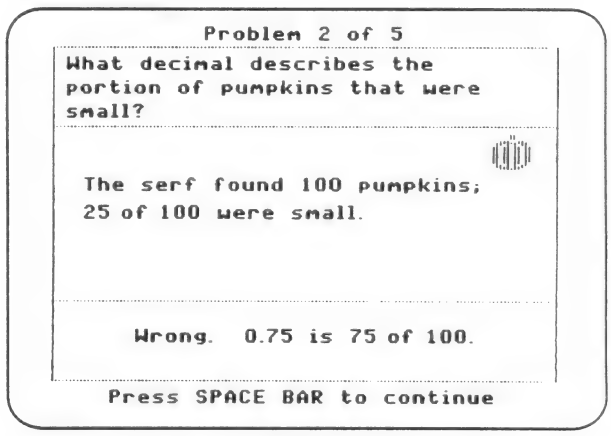
Problem 2 of 5
What decimal describes the portion of pumpkins that were small?
The serf found 100 pumpkins; 25 of 100 were small.
Wrong. 0.75 is 75 of 100.
Press SPACE BAR to continue

Figure 12

USE IN AN INSTRUCTIONAL SETTING (continued)

When unit rate is turned on, additional visual remediation is given to students having trouble identifying unit rates in Type A problems. After having correctly created the visual representation of a given ratio, students must identify the unit rate. If, after two attempts, students have not identified the answer, visual help is provided (Figures 13 and 14).

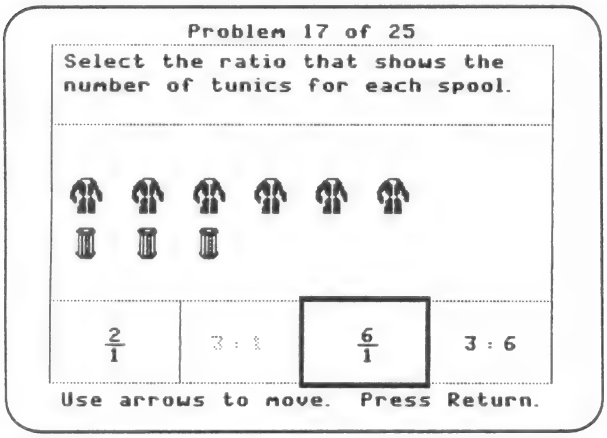

Figure 13

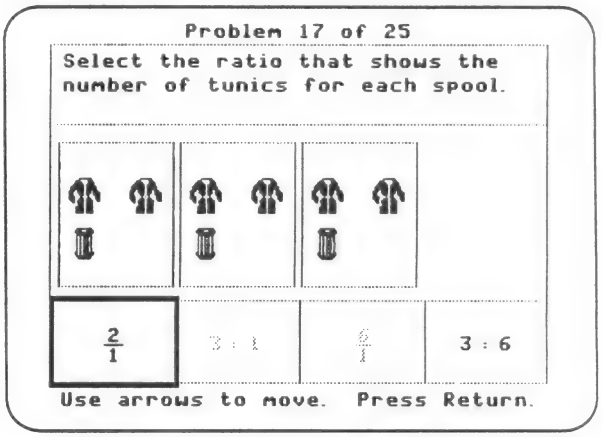

Figure 14

For students having trouble identifying unit rates in Type C problems, procedural remediation is provided. After having correctly identified a given ratio, students must identify the unit rate. Help is provided if, after two attempts, students have not found the answer (Figures 15 and 16).

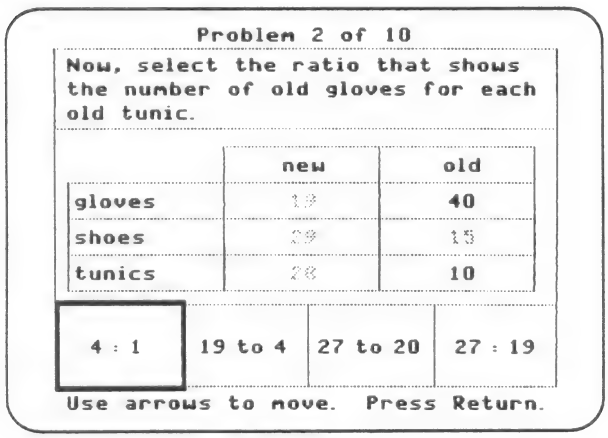

Figure 15

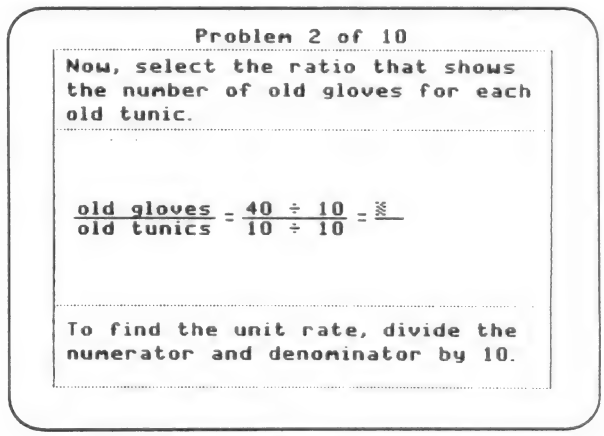
Problem 2 of 10
Now, select the ratio that shows the number of old gloves for each old tunic.
old gloves / old tunics = 40 ÷ 10 / 10 ÷ 10 =
To find the unit rate, divide the numerator and denominator by 10.

Figure 16

USE IN AN INSTRUCTIONAL SETTING (continued)

If students need to quit before completing the entire set, they should press the Escape (Esc) Key twice. This will give them a summary of their session and save the results for you to view. If students exit a program early and the game setting requires either mastery or completion of the problem set before playing the games, access to the games is not allowed (Figure 17). If students turn the computer off while in the middle of a session, the results will not be saved. At the conclusion of the program, a summary is given to the students, along with a list of options (Figure 18).

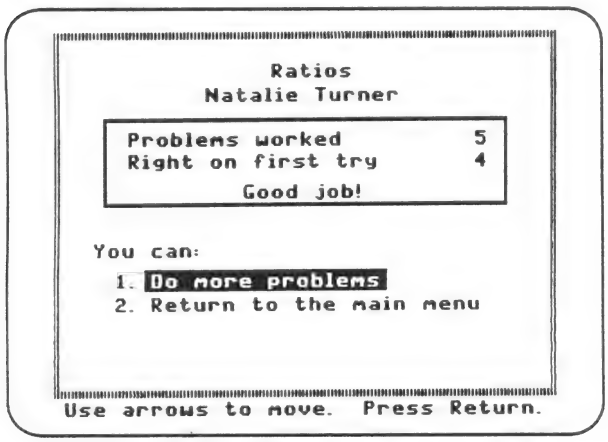

Figure 17

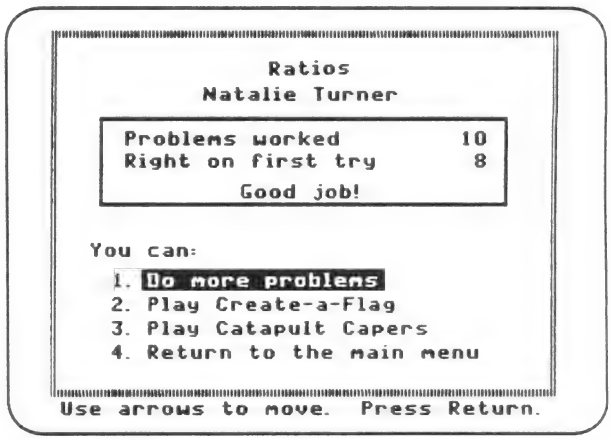

Figure 18

DESCRIPTION

Proportions gives students practice with setting up proportions and, using either the cross-multiplication or unit rate method, solving for an unknown. The number of problems per session, the problem types presented, and the mastery level are adjustable through the use of the Teacher Options. A guided practice sequence "steps" students through the process of setting up a proportion and solving for an unknown, providing remediation if students have difficulty with a problem. Content-related games can be made available to students following the session.

Curriculum Area:	Mathematics
Subject:	Proportions
Type:	Guided Practice
Grade Range:	5-8
Classroom Use:	Individual

LEARNING OBJECTIVES

After using this program, the student will have received practice in:

- setting up a proportion from information in a word problem;
- solving a proportion using cross-multiplication;
- solving a proportion using unit rate;
- extracting correct information from a word problem; and
- selecting correct information from a word problem when too much information is given.

USE IN AN INSTRUCTIONAL SETTING

Preparation

Since this is a reinforcement activity, it is assumed that students are familiar with the skills involved. Two problem types are available to students:

Type A: In these word problems, which contain too much information, the proportion is set up and students are required to solve for one unknown. If unit rate is turned off, students will solve for *n* by using only the cross-multiplication method (Figure 1); if unit rate is turned on, students will use only the unit rate method (Figure 2).

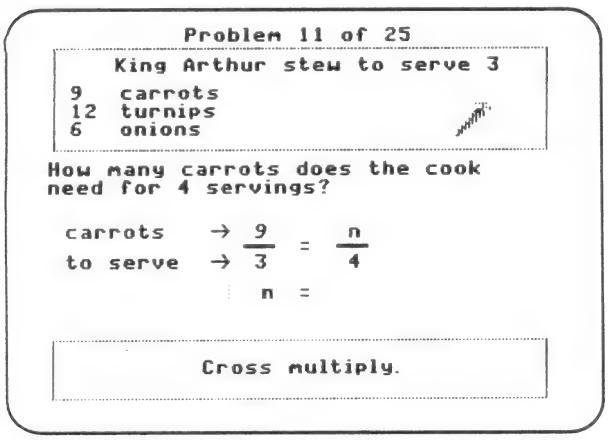

Figure 1

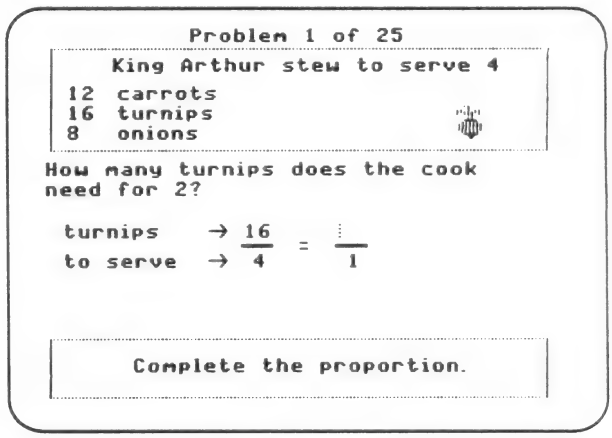
Problem 1 of 25
King Arthur stew to serve 4
12 carrots
16 turnips
8 onions
How many turnips does the cook need for 2?
turnips → 16/4 = /1
to serve →
Complete the proportion.

Figure 2

Type B: These word problems contain too much information. Students are required to extract the correct information, set up a proportion, and solve for one unknown. If unit rate is turned off, students will solve for *n* by using only the cross-multiplication method (Figure 3); if unit rate is on, students will use only the unit rate method (Figure 4).

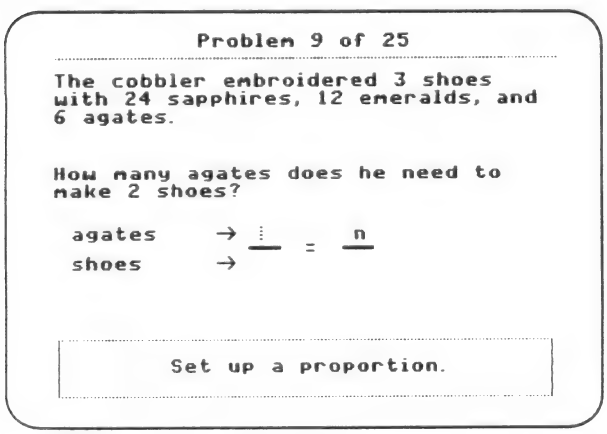
Problem 9 of 25
The cobbler embroidered 3 shoes with 24 sapphires, 12 emeralds, and 6 agates.
How many agates does he need to make 2 shoes?
agates → /
shoes → = n/
Set up a proportion.

Figure 3

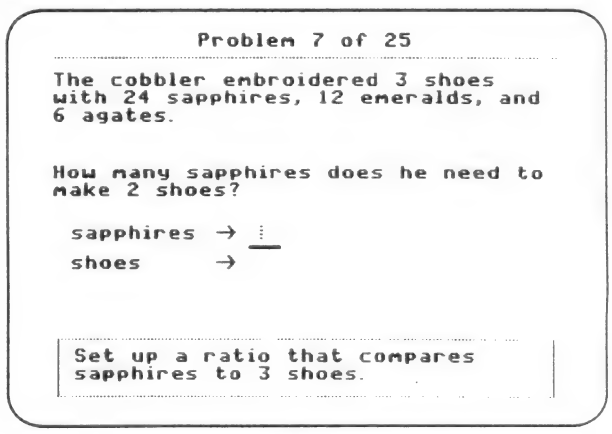
Problem 7 of 25
The cobbler embroidered 3 shoes with 24 sapphires, 12 emeralds, and 6 agates.
How many sapphires does he need to make 2 shoes?
sapphires → /
shoes →
Set up a ratio that compares sapphires to 3 shoes.

Figure 4

USE IN AN INSTRUCTIONAL SETTING (continued)

Using the Program

This program is meant to be used with individual students. Students must enter their names for record-keeping purposes (Figure 5). They are then given the full set of problems as designed by the teacher through the use of Teacher Options (Figure 6).

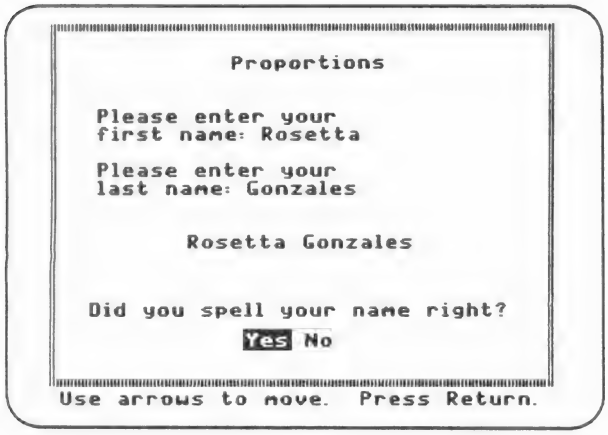
Proportions
Please enter your first name: Rosetta
Please enter your last name: Gonzales
Rosetta Gonzales
Did you spell your name right?
Yes No
Use arrows to move. Press Return.

Figure 5

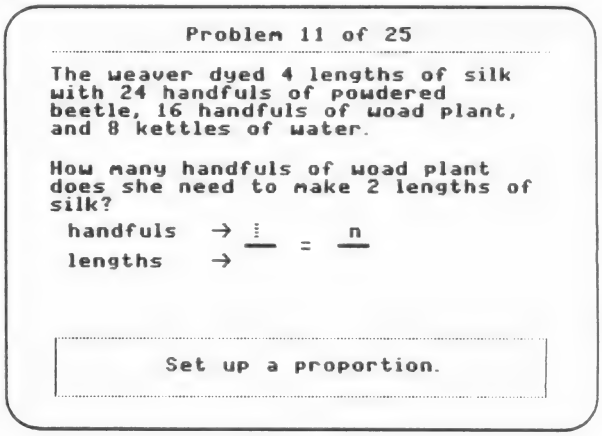
Problem 11 of 25
The weaver dyed 4 lengths of silk with 24 handfuls of powdered beetle, 16 handfuls of woad plant, and 8 kettles of water.
How many handfuls of woad plant does she need to make 2 lengths of silk?
handfuls → ⋮ = n
lengths →
Set up a proportion.

Figure 6

Through the unit rate setting in Teacher Options, you can determine if your students will solve for the unknown in each proportion problem using only the cross-multiplication method or only the unit rate method (Figures 7 and 8). The default setting is with unit rate turned off.

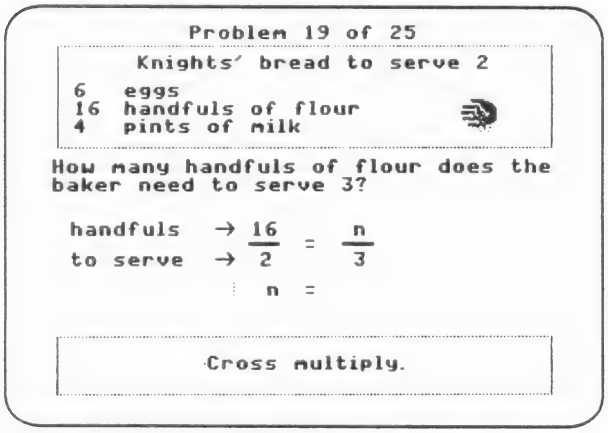
Problem 19 of 25
Knights' bread to serve 2
6 eggs
16 handfuls of flour
4 pints of milk
How many handfuls of flour does the baker need to serve 3?
handfuls → 16/2 = n/3
to serve → ⋮ n =
Cross multiply.

Figure 7

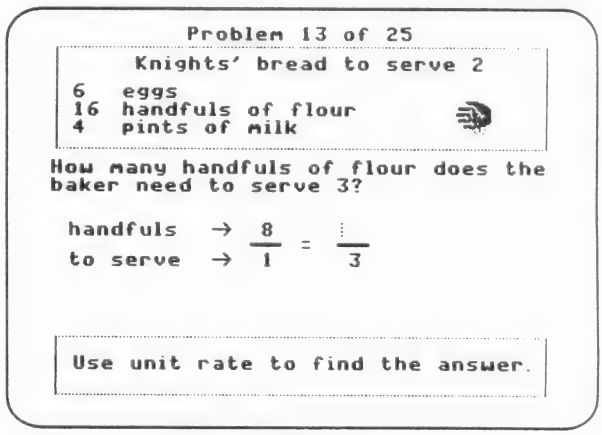
Problem 13 of 25
Knights' bread to serve 2
6 eggs
16 handfuls of flour
4 pints of milk
How many handfuls of flour does the baker need to serve 3?
handfuls → 8/1 = ⋮/3
to serve →
Use unit rate to find the answer.

Figure 8

USE IN AN INSTRUCTIONAL SETTING (continued)

Students enter a response by entering a value and pressing the Return Key. The arrow keys may be used to back up and change an entry. If students experience difficulty with any portion of the problem, an in-depth remediation sequence "steps" them through the process. An example of a remediation sequence with unit rate turned off is shown in Figures 9 and 10.

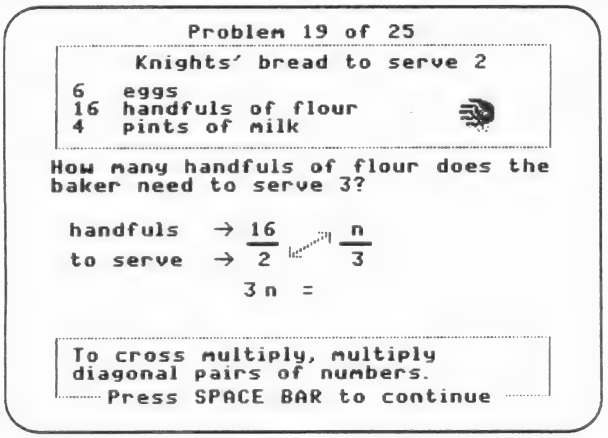
Problem 19 of 25
Knights' bread to serve 2
6 eggs
16 handfuls of flour
4 pints of milk
How many handfuls of flour does the baker need to serve 3?
handfuls → 16 n
to serve → 2 3
3 n =
To cross multiply, multiply diagonal pairs of numbers.
Press SPACE BAR to continue

Figure 9

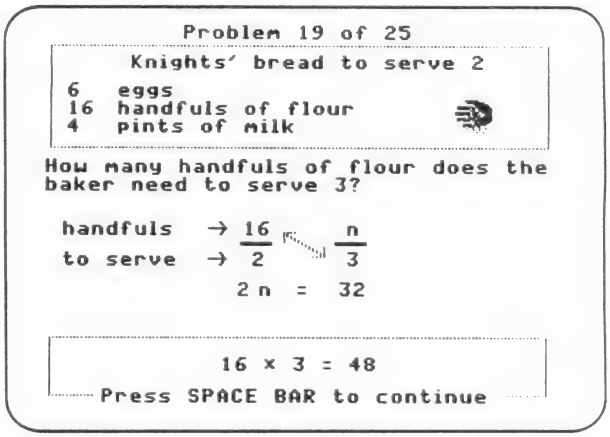
Problem 19 of 25
Knights' bread to serve 2
6 eggs
16 handfuls of flour
4 pints of milk
How many handfuls of flour does the baker need to serve 3?
handfuls → 16 n
to serve → 2 3
2 n = 32
16 x 3 = 48
Press SPACE BAR to continue

Figure 10

An example of a remediation sequence with unit rate turned on is shown in Figures 11 and 12.

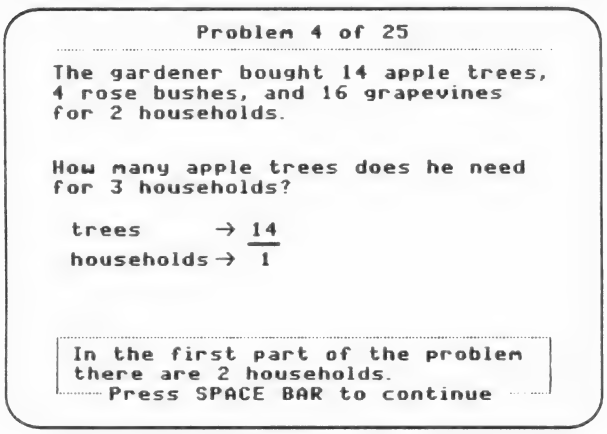
Problem 4 of 25
The gardener bought 14 apple trees, 4 rose bushes, and 16 grapevines for 2 households.
How many apple trees does he need for 3 households?
trees → 14
households → 1
In the first part of the problem there are 2 households.
Press SPACE BAR to continue

Figure 11

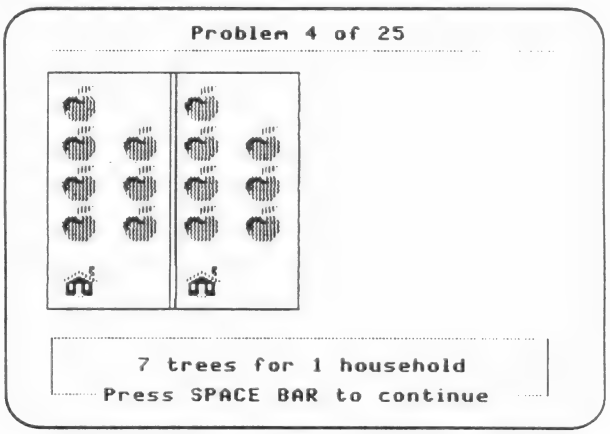

Figure 12

USE IN AN INSTRUCTIONAL SETTING (continued)

If students need to quit before completing the entire set, they should press the Escape (Esc) Key twice. This will give them a summary of their session and save the results for you to view. If students exit a program early, and the game setting requires either mastery or completion of the problem set before playing the games, access to the games is not allowed (Figure 13). Students who exit a program early are returned to the menu without the option to play one of the games. If students turn the computer off in the middle of a session, the results will not be saved. At the conclusion of the program, a summary is given to the students along with a list of options (Figure 14).

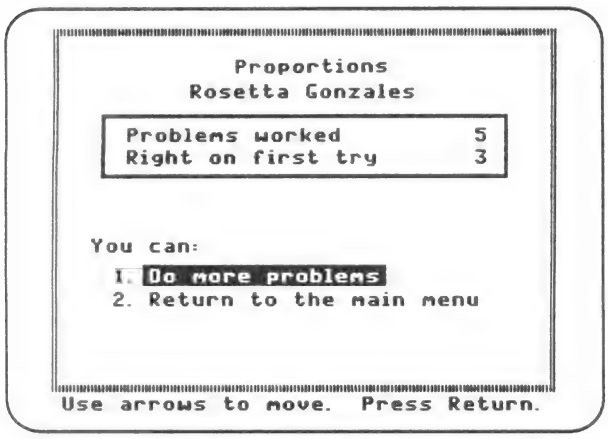

Figure 13

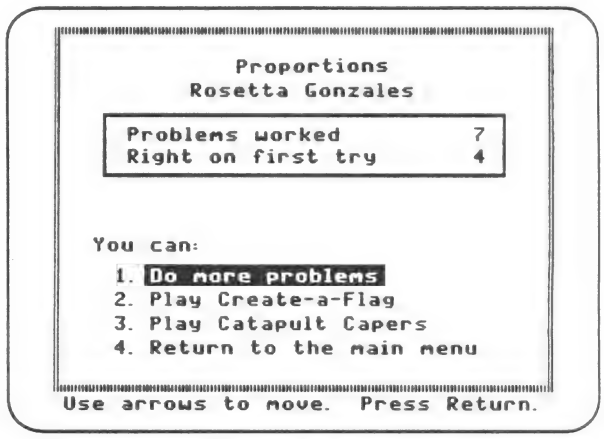

Figure 14

DESCRIPTION

Create-a-Flag is an exploratory activity in which students experiment with ratios as they design their own castle flag. Students select two symbols to place on their flag and use ratios to determine the size of the flag and the numbers of each of the symbols. Students may adjust the ratio of the symbols or the ratio of the height to the length of the flag as often as they like. Flags may be printed if a printer is available.

Curriculum Area:	Mathematics
Subject:	Ratios
Type:	Educational Game
Grade Range:	5-8
Classroom Use:	Individual

PURPOSE

The primary purpose of the **Create-a-Flag** activity is to reinforce the concept of relationships involved in ratios in a stimulating and creative format. Because the activity allows students to easily manipulate ratios and visually see the results, **Create-a-Flag** is an excellent exploratory activity.

This activity may be used to motivate students to finish or master a problem set. It is possible, through the use of Teacher Options, to control students' access to this activity. You can set the disk so that students are allowed to use this activity only after completing a set of addition or subtraction problems. You can even add the stipulation that they must reach a certain mastery level before being allowed to create a flag.

USING THE GAME

The object of **Create-a-Flag** is to design a flag by using ratios to determine the size of the flag and the pattern of symbols. The object of the activity is summarized before the students begin (Figures 1 and 2).

Create-a-Flag
Every castle needs a flag to fly over its kingdom. Because you are so creative, you have been chosen to design the castle flag. This flag will proudly represent all of the people of the kingdom.
Press SPACE BAR to continue

Figure 1

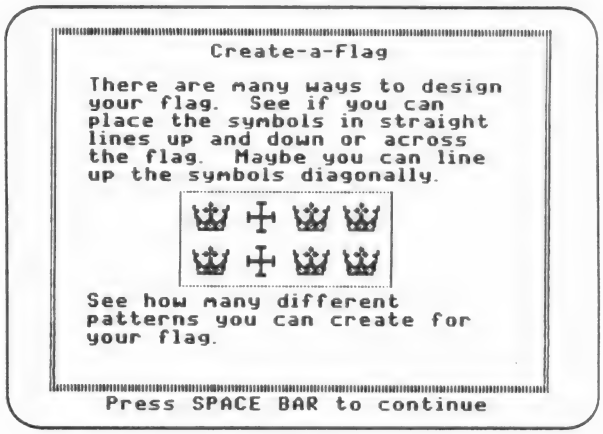
Create-a-Flag
There are many ways to design your flag. See if you can place the symbols in straight lines up and down or across the flag. Maybe you can line up the symbols diagonally.
See how many different patterns you can create for your flag.
Press SPACE BAR to continue

Figure 2

Students then enter their first names and choose their titles (Figure 3). Next, students select two symbols to fill their flag (Figure 4). Students are given the opportunity to change their flag symbols before continuing.

Figure 3

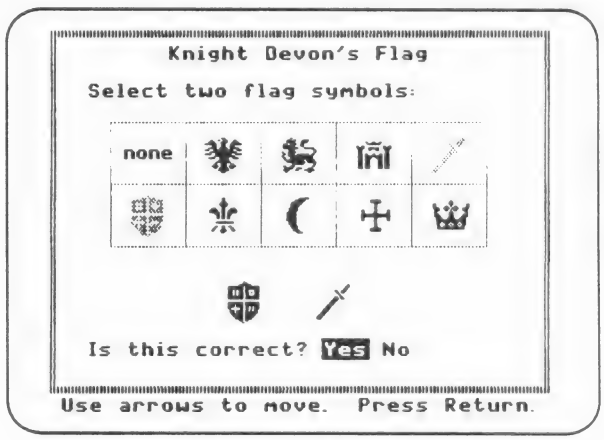

Figure 4

USING THE GAME (continued)

Students next set the ratio for the dimensions of their flags. The maximum size is a height of 4 and a length of 8 (Figure 5). Students then select a ratio from a list that describes the relationship of the two symbols they wish to have displayed on their flags (Figure 6). Students are given the opportunity to change the ratio of symbols before continuing.

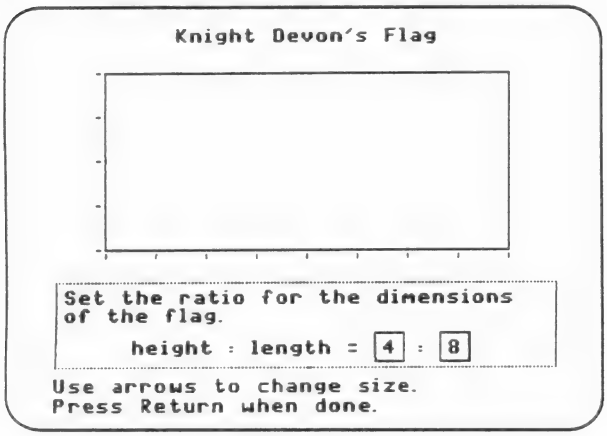
Knight Devon's Flag
Set the ratio for the dimensions of the flag.
height : length = 4 : 8
Use arrows to change size.
Press Return when done.

Figure 5

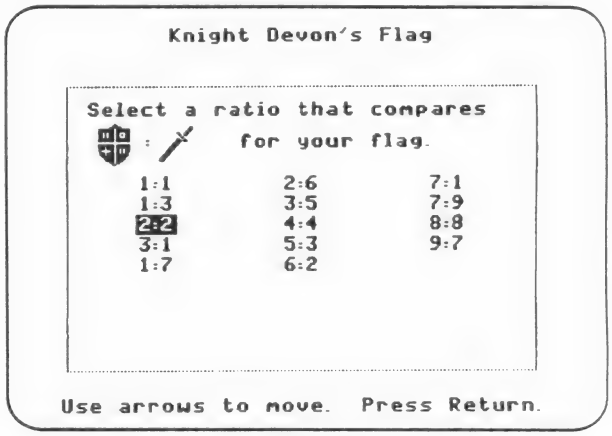

Figure 6

Next, students must place the symbols on their flag. The computer will automatically fill in the symbols, but students must specify the starting point (Figure 7), as well as the direction in which the flag should be filled (Figure 8). Both the starting point and the direction of the fill will make a difference in the pattern that emerges. Once both have been specified, the flag will fill using the appropriate ratio of the symbols.

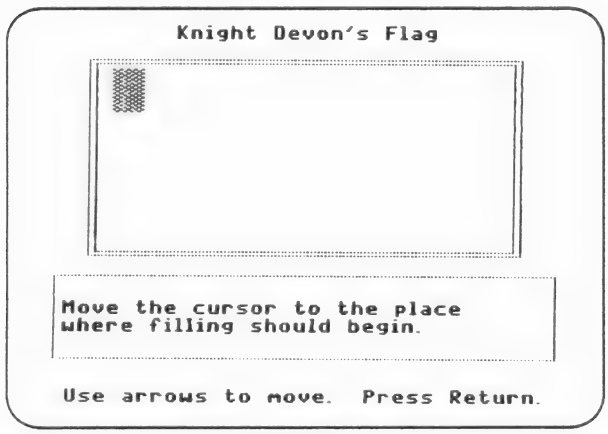

Figure 7

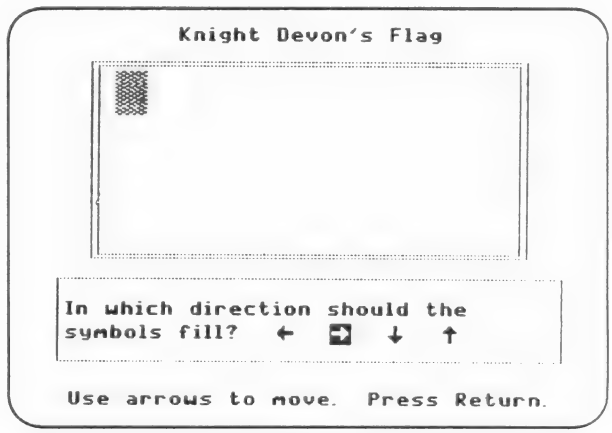

Figure 8

USING THE GAME (continued)

After the flag has been filled, students may choose to change the flag, see the flag, print the flag, or quit (Figure 9). If students choose to change the flag, they may change one or all of the following: the fill, the ratio of symbols, the size of the flag, or the symbols (Figure 10). To print flags, the print option must be turned on in the Teacher Options (Option 5: Change Print Selection). After seeing or printing a flag, students return to the menu shown in Figure 9.

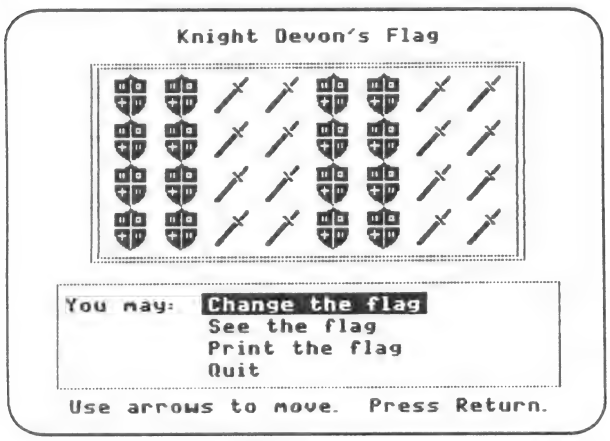

Figure 9

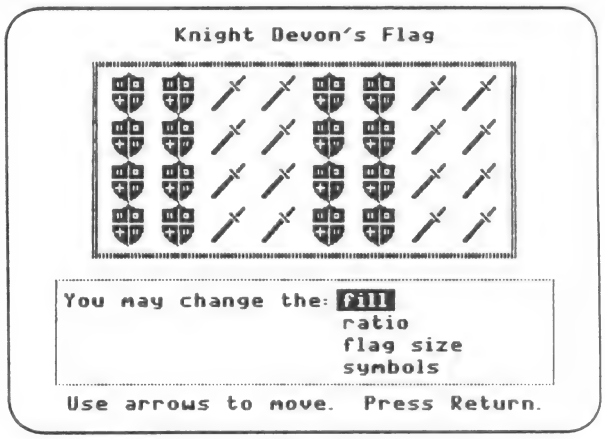

Figure 10

DESCRIPTION

Catapult Capers is a problem-solving game in which students try to hit a target by setting the correct ratio of a rock's weight to the force of a catapult.

Curriculum Area:	Mathematics
Subject:	Ratio and Proportion
Type:	Educational Game
Grade Range:	5-8
Classroom Use:	Individual

PURPOSE

The primary purpose of **Catapult Capers** is to promote proportional thinking. As students attempt to hit a target with a rock hurled from a catapult, they must consider the given weight of the rock and the effect of the force they select. After some probable trial-and-error, they will begin to see the relationship between weight, force, and distance. They can then create equivalent ratios and consistently hit the target.

This game may be used to motivate students to finish or master a problem set. It is possible, through the use of the Teacher Options, to control students' access to this game. You can set the disk so that students are allowed to play this game only after completing a set of ratio or proportion problems. You can even add the stipulation that they must reach a certain mastery level before being allowed to play the game.

USING THE GAME

Catapult Capers simulates the effect of the proportional relationship between weight and force. The procedure and rules for playing **Catapult Capers** are:

1. The game is designed for one student. Students can compete, however, by attempting to individually score the maximum number of points (500) in a single game.

2. Students select from three levels of difficulty: Apprentice, Sharpshooter, or Master. They begin the game with a set of 10 rocks with varying whole-number weights from 3 to 8 in the Apprentice and Sharpshooter levels and from 1 to 88 in the Master level.

3. A rock appears in the catapult, with the weight of the rock displayed to the left of the catapult. Students enter a force from 1.0 to 10.0 in the Apprentice and Sharpshooter levels and from 1.0 to 100.0 in the Master level. They then press the Return Key to hurl the rock and evaluate the result. If the rock hits any ring on the target, the ring will flash and the earned points will appear on the scoreboard. In the Apprentice level, if the target is not hit on the first try, the weight of each new rock will remain constant until students select the correct force to hit the bull's-eye.

4. After students create each ratio of weight to force and press the Return Key to hurl the rock, the ratio will slide to the easel. Students may use the arrow keys to review their previous tosses. This sequence continues until all the rocks are hurled.

The rules for **Catapult Capers** are summarized for students before starting the game (Figure 1). Students then select from the three levels of difficulty (Figure 2).

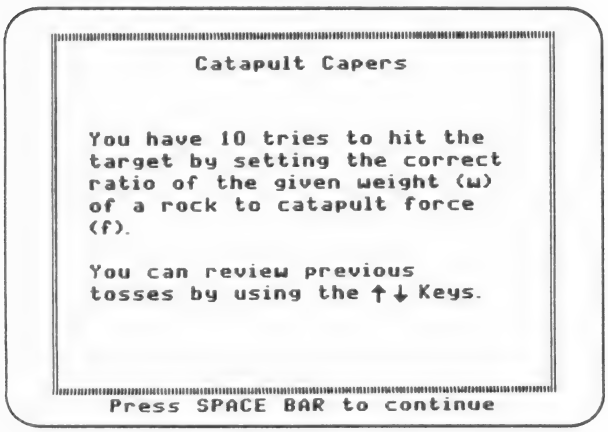
Catapult Capers
You have 10 tries to hit the target by setting the correct ratio of the given weight (w) of a rock to catapult force (f).
You can review previous tosses by using the ↑↓ Keys.
Press SPACE BAR to continue

Figure 1

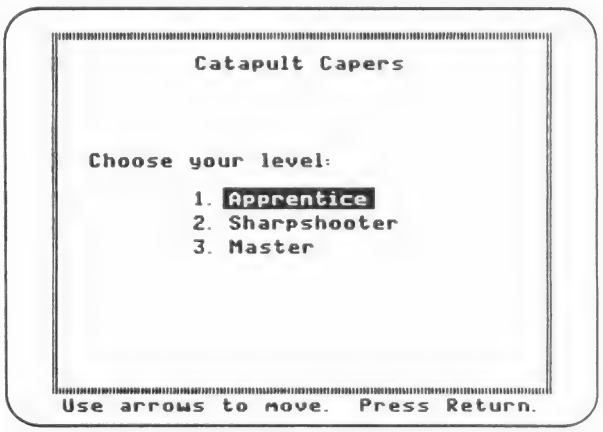

Figure 2

USING THE GAME (continued)

A catapult with a rock appears on the screen; the whole-number weight of the rock is displayed at the left of the catapult. Students must enter a force from 1.0 to 10.0 in the Apprentice and Sharpshooter levels (Figure 3) and from 1.0 to 100.0 in the Master level. When students press the Return Key, the rock is hurled toward the target and the ratio of weight to force that students have created slides to the easel (Figure 4). Previous tosses can be reviewed on the easel using the arrow keys.

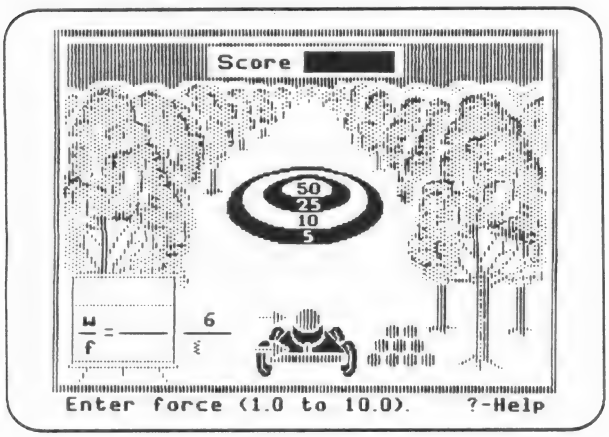

Figure 3

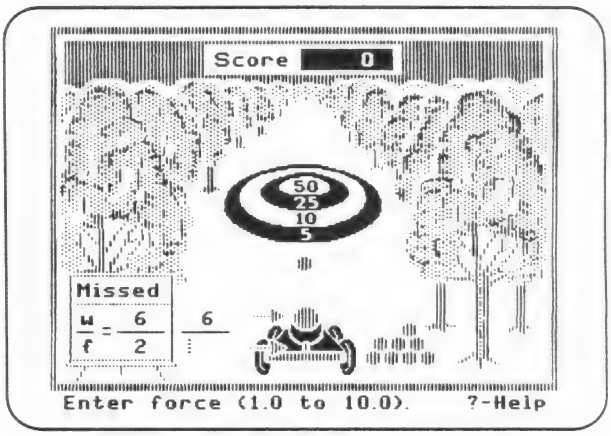

Figure 4

In the Apprentice level, if the force set by students does not result in the rock hitting the bull's-eye, the weight of the rock will remain constant for each toss until students enter a force that hurls the rock to the bull's-eye (Figure 5). If the rock hits any ring on the target, the ring flashes and the earned points accumulate on the scoreboard (Figure 6).

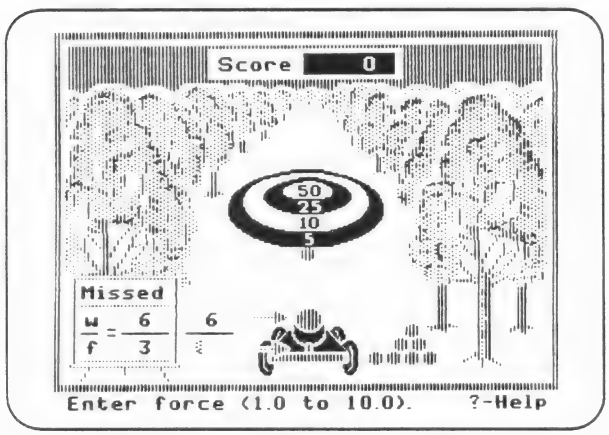

Figure 5

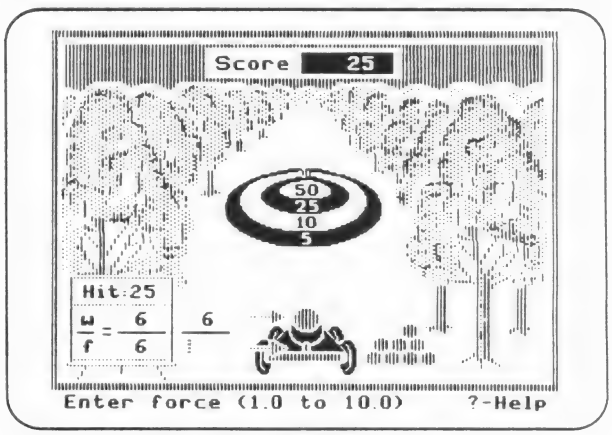

Figure 6

USING THE GAME (continued)

In the Apprentice level, when students correctly create the ratio that hurls the rock to hit the bull's-eye, they receive a message encouraging them to form equivalent ratios (Figure 7). The game ends when students have created ratios to hurl all 10 rocks. Students are then given a choice of playing another game (Figure 8). If students select "Yes," a new game of **Catapult Capers** begins; if they select "No," they return to the main menu. No records of students' scores are kept for **Catapult Capers.**

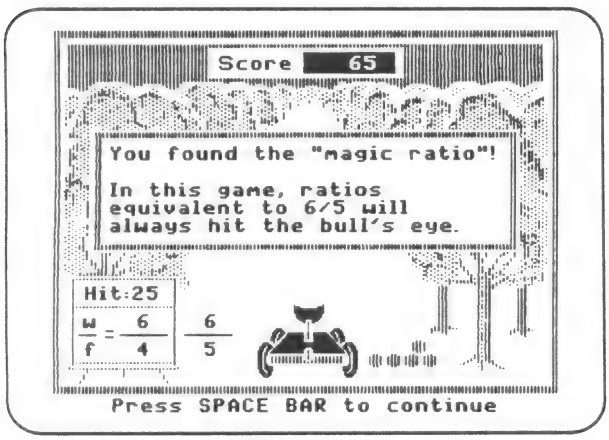
Score 65
You found the "magic ratio"!
In this game, ratios equivalent to 6/5 will always hit the bull's eye.
Hit:25
w/f = 6/4
6/5
Press SPACE BAR to continue

Figure 7

Figure 8

Appendices

Appendix A

CREDITS

Conquering Ratios and Proportions was produced by a MECC development team that included Sheila Dols, Shari Glenn, Scott Jensen, Charolyn Kapplinger, Diana Lin, Sherry Luedloff, Jane Peterson, and Craig Solomonson.

MECC wishes to extend special thanks to the following teachers and their students for their assistance in the development of this package:

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TO THE READER:

MECC has made every effort to ensure the instructional and technical quality of this courseware package. Your comments—as user or reviewer—are valued and will be considered for inclusion in any future version of the product. Please address comments to:

MECC Courseware Development
3490 Lexington Avenue North
St. Paul, MN 55126

USING A PRINTER WITH THIS COURSEWARE

This product is initially set to work with a standard printer card located in either Slot 1 or Slot 2. If you have this setup, you do not need to do anything further. If you are connecting an Apple //c or IIGS computer, we recommend that you designate Slot 1 and use the computer's printer port. If your printer uses another setup, or if you need to enter special printing commands, you must use the Printer Support option.

The Printer Support option appears on the Teacher Options menu (Figure 1). You may access the Teacher Options from the main menu by typing Control-A. From the Teacher Options menu, selecting Option 6 takes you to the Printer Support menu (Figure 2). The current printer settings are shown at the top of the screen.

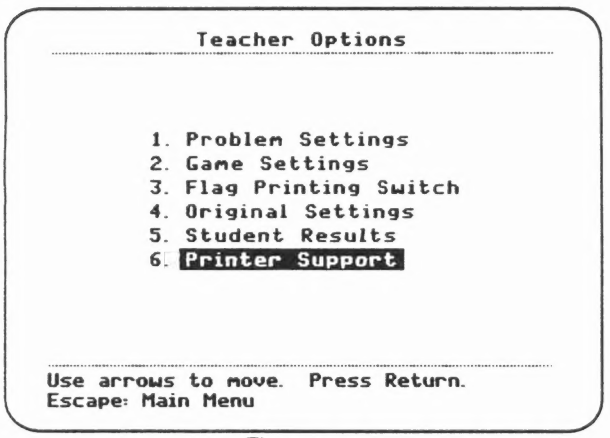

Figure 1

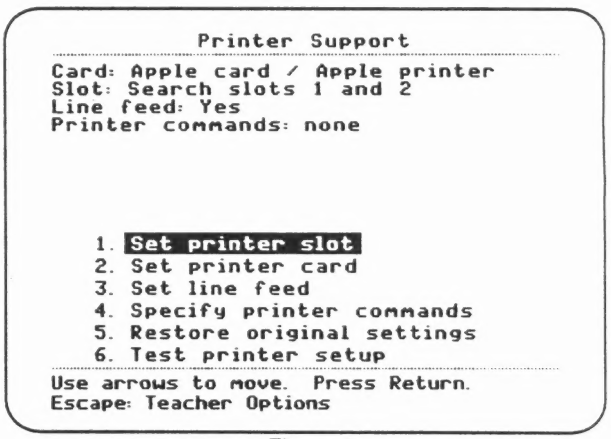
Printer Support
Card: Apple card / Apple printer
Slot: Search slots 1 and 2
Line feed: Yes
Printer commands: none
1. Set printer slot
2. Set printer card
3. Set line feed
4. Specify printer commands
5. Restore original settings
6. Test printer setup
Use arrows to move. Press Return.
Escape: Teacher Options

Figure 2

Option 1, Set printer slot: This option allows you to specify the slot in which your printer interface card is located (Figure 3).

Option 2, Set printer card: This option allows you to select the type of printer interface card you are using (Figure 4). Other interface cards may work; however, to ensure that students can print flags in **Create-a-Flag**, you need to use either an Apple or Grappler printer card.

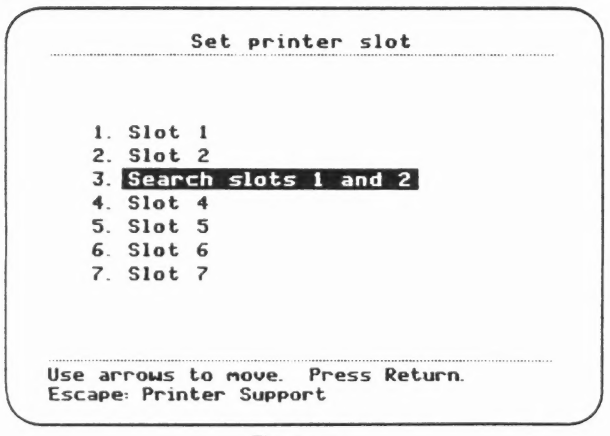

Figure 3

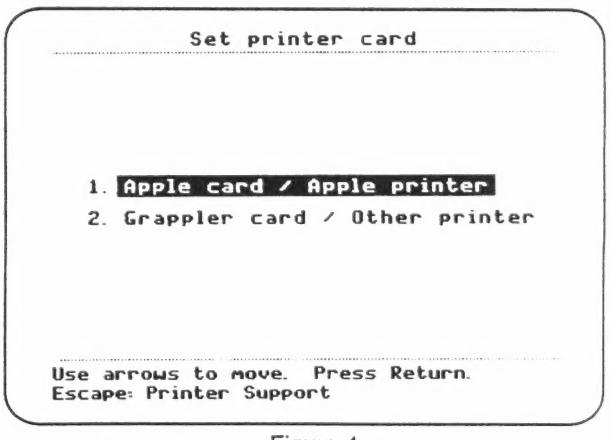
Set printer card
1. Apple card / Apple printer
2. Grappler card / Other printer
Use arrows to move. Press Return.
Escape: Printer Support

Figure 4

Option 3, Set line feed: This option allows you to turn on or off a line feed after each carriage return (Figure 5). Use this option to set the line feed if student records or flags from **Create-a-Flag** are not printing correctly.

Option 4, Specify printer commands: This option allows you to enter commands that enable certain types of printers to operate. These special commands are listed in the manufacturer's printer or interface card manual. Figure 6, for example, shows the special command you would enter to produce "ultracondensed" printing (17 cpi) on an Apple Dot Matrix or Apple ImageWriter. To enter special commands, type the exact characters required. When finished, type ^ (Shift-6) to end.

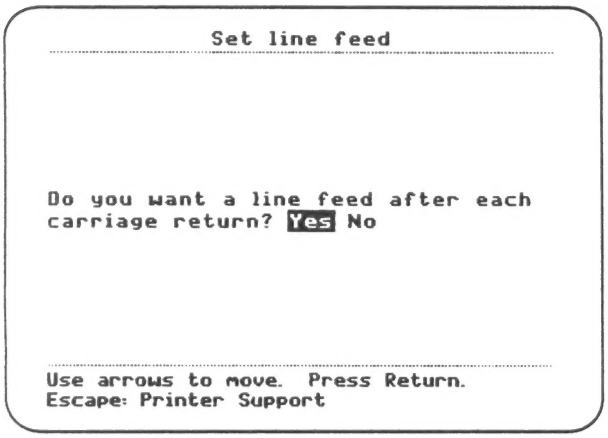
Set line feed
Do you want a line feed after each carriage return? Yes No
Use arrows to move. Press Return.
Escape: Printer Support

Figure 5

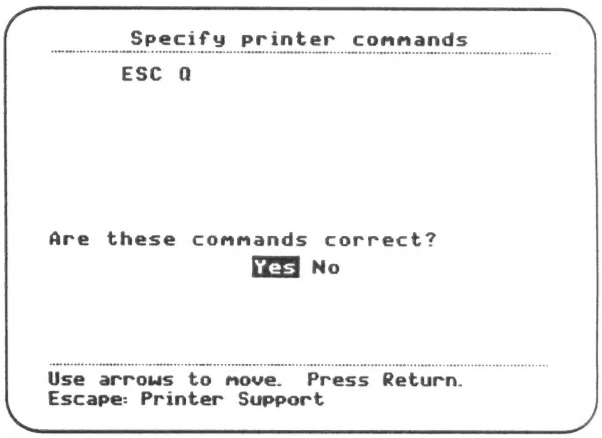

Figure 6

Here are some other frequently used special commands for the Apple Dot Matrix and ImageWriter printers:

Type Style:	Pica (10 cpi)	Elite (12 cpi)	Bold
Command:	Escape N	Escape E	Escape !

Do not set up your printer to use a proportional font. This setting will cause printed student records to be formatted incorrectly.

Option 5, Restore original settings: This option returns all printer settings to their original state. The original printer setup provides a search of Slots 1 and 2 and does not use any special printer commands.

Option 6, Test printer setup: This option allows you to test printing of both text and graphics. If the text or graphics are not printed correctly, check the settings on you printer, check to see whether your printer has been connected correctly, or look at your interface card manual for special commands.

All changes made to the Printer Support settings are saved on the disk and are permanent until you use the Printer Support option again to change the printer settings.

Appendix C

REFERENCES

These references provide additional reading materials on the concepts of ratio, proportion, and unit rate.

Goodstein, Madeline P. *Sci Math–Applications in Proportional Problem Solving*. Menlo Park, Calif.: Addison-Wesley Publishing Co., 1983.

Karplus, Robert, Steven Pulas, and Elizabeth Stage. "Proportional Reasoning and Early Adolescents." In *Acquisition of Mathematics Concepts and Processes*. Edited by Richard Lesh and Marsha Landau. New York: Academic Press, 1983.

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Post, Thomas R., Merlyn Behr, and Richard Lesh. "Proportionality and the Development of Prealgebra Understandings." In *The Ideas of Algebra, K-12*, edited by Arthur F. Coxford and Albert P. Shulte, 78-90. Reston, Virginia: The National Council of Teachers of Mathematics, Inc., 1988.

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Wollman, Warren, and Robert Karplus. "Intellectual Development Beyond Elementary School V: Using Ratio in Differing Tasks." *School Science and Mathematics 74* (November 1974): 593-613.

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